ENERGY EFFICIENCY AND CANADA'S REGULATORS: TWO PERSPECTIVES

Submitted by | **CAMPUT**

Summary: CAMPUT is the Association of Canada's provincial, territorial and federal energy and utility regulators. Its purpose is to further regulatory excellence across Canada. The energy sector is undergoing significant transformation, offering tremendous opportunities but also presenting serious challenges for regulators. CAMPUT responds to these challenges by collaborating with partners to exchange knowledge and expertise and foster rapid implementation of global best practices. We work with regulators in other jurisdictions, including NARUC (National Association of Regulatory Utility Commissioners) in the US, and ICER (International Confederation of Energy Regulators). CAMPUT also works with academic and research groups in Canada to further regulatory excellence in areas of current focus.

Below, we highlight the work of two of our members, the British Columbia Utilities Commission (BCUC) and the Canada Energy Regulator (CER), to show some of the important ways regulators are addressing energy efficiency.

British Columbia Utilites Commission

In 2019, a staff member at the British Columbia Utilities Commission (BCUC) presented an approach to the evaluation of energy efficiency programs as part of an international cooperative project. This evaluation approach was subsequently presented to CAMPUT members and turned into a paper published by the International Association of Energy Economists. We present here an overview of the paper.

'EFFECTIVENESS AND BALANCE' APPROACH

When looking at energy markets it is important to start with a definition of 'success'. Should 'success' be defined as only focusing on efficient supply of electricity, or do we also care about whether customers are efficient in their use of electricity once it is delivered?

This article proposes that 'success' is when customers receive their heat, light, power (and now with the advent of electric cars, even transportation) at the lowest total cost. This means that we should focus on the whole market - promoting both the efficient supply and efficient use of electricity.

However, if we discover that the market is not being efficient at delivering the needed services because customers are wasting electricity supplied to them, who should fund programs to fix these market barriers?

Companies operating in a competitive environment are generally not in the business of helping their customers use less of their product by reducing waste. This is because lower sales would typically result in lower profits. However, regulated utilities are different. In their case, the regulator (such as the BCUC) can allow the utility to recover the cost of energy efficiency programs in their rates, and can even provide a financial incentive to run these programs effectively.

Now we have established that mitigating demand-side market barriers is a good idea, and that funding could come from regulated utilities, we can move onto identifying which energy efficiency programs should be offered.

This is a three-step process.

- **Step one** identifies whether there are demand side inefficiencies in the market – where is electricity being wasted?
- **Step two** identifies the market barriers causing the inefficiency, designs energy efficiency programs to mitigate the market barriers, and identifies if it is cheaper for the utility to 'nudge' a customer into being more efficient instead of continuing to supply the electricity that is being wasted.
- **Step three** ensures that, as all customers contribute towards the cost of these programs in their rates, all customers, and in particular 'hard to reach' customers, are given an opportunity to participate in them.

STEP ONE: IS THERE A PROBLEM?

This first step is to figure out where electricity is being wasted. Consider a customer with an old ceiling fan: we want to find out if the electricity market would be more efficient if the customer replaced this old fan with a new, more efficient one. The first step is a cost/benefit test and is called the total resource cost test or societal cost test depending on the inputs being used:

- For the cost we use the cost of the new efficient ceiling fan, before any incentives or rebates are applied. For example, if a new fan costs $100 but the customer only pays $80 because there is a $20 energy efficiency incentive, we ignore the $20 discount and use the full $100 for the cost of the fan.
- On the benefit side, we want to quantify the value of the energy saved if the customer installs the new fan. This isn't the reduction in the customer's bill, but is instead the value of energy saved to the utility, including any additional utility benefits (such as reduced network losses) as the energy is saved at the customer's location.
- Broader societal benefits can also include emission reduction benefits or non energy benefits, for example the new efficient fan may be quieter than the old fan.

If the benefits exceed the costs in this first test, we have identified that the market would be more efficient overall if we could nudge customers into replacing their old fan.

STEP TWO: CAN THE UTILITY FIX THE PROBLEM?

This second step identifies if the utility can cost-effectively fix the problem. It is important to do this second step as not all market barriers are cost-effective for the utility to fix.

This second step requires first identifying why customers are not making efficient consumption decisions. For example, why is the customer not replacing their old, inefficient fan? In this scenario market barriers could include a high upfront cost, lack of information, lack of time or an inefficient utility rate design.

Once you have done your research and identified the market barriers that prevent a customer from making efficient decisions, you can then design energy efficiency programs to nudge the customer into changing their behaviour. For example, nudges could include giving the customer a cash incentive to install a more efficient fan, customer education programs or working with retailers to ensure the more efficient fans are in stock. Programs could also include assisting local governments to establish new codes or standards (such as those that require the building of more efficient homes) or developing more efficient rate designs.

Once you have designed energy efficiency programs to address the market barriers, the last part of this second step is another cost/benefit test. This cost/benefit test measures whether the energy efficiency program is cheaper to the utility than the cost of supplying the electricity that would otherwise be wasted. This test is called the utility cost test.

In this test, the cost is the cost to the utility of nudging the customer into changing their behaviour. This would include the cost of any incentives provided to the customer and the administration of the program. Benefits will include the value of energy saved to the utility as before. However, there are some nuances to this calculation:

- There may be some customers who participated in an energy efficiency program when they would have, for example, installed an efficient fan anyway. These customers are referred to as 'free riders' and the energy associated with estimated free riders should be deducted from the total energy savings estimated to result from the program.
- The other side of this is where a customer undertakes an energy efficiency investment as a result of an energy efficiency program, but without directly participating in it (for example, where the program helps to transform the market). This estimated 'spillover' effect can act to increase the estimated energy savings.

If a program passes this second step it demonstrates that offering the program will reduce utility costs overall as the utility cost of reducing waste is lower than the cost of supplying the wasted electricity.

STEP THREE: BALANCE CONSIDERATIONS

While these first two steps can show that an energy efficiency program makes the market more efficient and reduces utility costs overall, there is still the equity concern around who benefits and who pays. To address this issue there is a third step that needs to be done. We need to ensure that, if all customers are paying towards the cost of these programs in their rates, then all customer should have a reasonable opportunity to participate in them.

This can be done by reviewing utility programs by customer class and/or by region to ensure that a reasonable level of funding is allocated to each group. You don't need to require funding levels to be the same for each customer segment, however this third step ensures that energy efficiency funding is not just targeted towards the lowest cost group.

Equity considerations also require a review of energy efficiency programs to ensure that they include programs specifically designed to target 'hard to reach' customers, such as low-income customers and renters. In BC, for example, there is a requirement that programs specifically targeting these 'hard to reach' customer segments are included in the portfolio.

It is also important not to discount programs that can have significant benefits (such as education programs) just because their energy savings can be hard to measure. In BC, for example, utilities are specifically required to offer educational energy efficiency programs.

ELECTRIFICATION PROGRAMS

Electrification programs may not be seen as typical energy efficiency programs as the participating customer ends up using more, not less, electricity. However, energy efficiency programs are used to make the market more efficient, and an efficient market could also include a customer fuel switching to electricity (for example, by purchasing an electric car).

For the most part, the same three steps still apply when looking at electrification programs. These programs should still pass the first test to ensure any 'nudge' is beneficial to society overall.

However, the cost effectiveness test for the second step – to determine if it is cost effective for the utility to offer these programs - will be different. In BC, instead of using the utility cost test as the cost/benefit test for electrification programs the ratepayer impact test is used. This test measures whether the profits the utility would make on the additional sales to customers that result from the program exceed the cost of the electrification program put in place.

For example, consider an electrification program that mitigates market barriers to customer investment in electric vehicles. If the revenue earned by the utility from the additional electricity sales it generates as a result of the electrification program exceeds the cost of the program, then it will be cost-effective for the utility to undertake.

The third step is less important for electrification programs as all customers, those that participate in the program and those that do not, can benefit from an increase in profitable utility sales.

CONCLUSION

Energy efficiency programs that encourage customers to be more efficient in their use of energy can be a low-cost way of meeting energy needs. The approach described above should help ensure that these programs are both cost-effective and address equity concerns around who pays and who benefits.

For those interested in additional information the full paper can be found at https://www.iaee.org/en/publications/newsletterdl.aspx?id=921.

CANADA ENERGY REGULATOR

The Canada Energy Regulator (CER) uses economic and energy models to produce the Energy Futures series, which explores possible energy futures for Canadians. The projections are based on assumptions about future trends in technology, energy and climate policies, energy markets, human behaviour, and the structure of the economy. Here we highlight the key role of energy efficiency within Canada's energy transition, using the results from Canada's Energy Future 2020: Energy Supply and Demand Projections to 2050 (Energy Futures 2020), the CER's latest long term energy outlook.

Global and Canadian ambition to reduce greenhouse gas (GHG) emissions will be a critical factor in how Canada's energy system evolves. *Energy Futures 2020* considers two main scenarios, where energy supply and demand estimates differ based on the level of action to reduce GHG emissions through energy and climate policies, and technological advancements.

Energy efficiency is captured in our modelling by a representation of how the stock of energy-related technologies evolves within the economy. Technologies compete based on relative costs to supply energy services. For instance, different types of natural gas-burning furnaces and electric heat pumps, among other technologies, provide residential space heating. Within this framework, energy efficiency is represented by two interdependent model dynamics.

First, efficiencies are assigned to individual technologies using engineering and consumer choice relationships. These efficiencies can change over time. For example, natural gas-burning furnaces might become more efficient over time, burning less fuel and lowering operating costs. Second, the average energy efficiency of an energy service can change through technology market share adjustments. If a more energy efficient technology captures a larger market share, the average energy efficiency of providing the energy service will improve. For example, households might replace aging natural gas furnaces with energy efficient electric heat pumps, improving the average efficiency of home heating.

There is a strong link between energy and climate policies and the pace of technological change, including energy efficiency improvements. Policy frameworks are key drivers of innovation and greater use of GHG-reducing technologies. For instance, a high carbon price improves the economics of high efficiency furnaces relative to their low efficiency alternatives. *Energy Futures 2020* explores this link by varying both the stringency of climate policies and technological advancements through two scenarios. Table 1 describes specific policy initiatives included in *Energy Futures 2020*.

***Table 1**: Overview of Policy Assumptions*

Key Current Policy Assumptions

Current policies are the base for policy assumptions in the Evolving Scenario. The Reference Scenario only includes current policies.

Carbon Pricing
Current provincial and territorial systems, as well as the Federal Carbon Pricing Backstop.

Coal Phase Out
Traditional coal-fired generation is phased out of electricity generation by 2030.

Energy Efficiency
Currently in place regulations including appliance standards, building codes, and vehicle standards.

Electric Vehicles
Provincial policies and initiatives including those in B.C. and Quebec, as well as Federal rebates and infrastructure program.

Renewable Energy
Current requirements for renewable electricity, and blending of ethanol, biodiesel and renewable natural gas.

Key Future Policy Assumptions

Future policy assumptions are hypothetical increases in policy stringency. They are only included in the Evolving Scenario.

Rising cost of Carbon Emissions
- Carbon prices continue to rise beyond 2022, to $125 in 2019 real terms by 2050.
- Credits for large emitters are gradually reduced over the projection period.

Reduced Emission Intensity of End-Uses
- Gradually stronger energy efficiency regulations across the economy, including net zero ready building codes, improving appliance standards, and increasing light-duty vehicle efficiency standards.
- Low Carbon/Clean Fuel Standard: Average emission intensities of fuels are gradually reduced over the projection period through increased use of renewables, end-use switching, and upstream emission reductions.
- ZEV mandates: Requirements for ZEVs in new sales are gradually introduced and/or increased over the outlook period.

Support for Clean Energy Technology and Infrastructure
Policy continues to support new technology development as well as key infrastructure developments including electric transmission, carbon capture and storage, and electric vehicle charging infrastructure.

The Evolving Scenario considers the impact of continuing the trend of increasing global action on climate change, including a hypothetical set of future policies. It includes technologies currently in the early stages of commercialization in the latter half of the projection period, and assumes lower costs and greater energy efficiency of technologies, which reduces the GHG intensity of the energy system. This includes established technologies, such as wind and solar power, as well as some emerging technologies with limited commercial adoption today.

The **Reference Scenario** considers a future where action to reduce GHG emissions does not develop beyond measures currently in place. The Reference Scenario assumes only moderate technological progress, including incremental energy efficiency improvements and cost reductions for well-established technologies, and no adoption of emerging technologies.

The interplay between energy efficiency and energy and climate policies is a key driver of Energy Future 2020 results. The differences in energy efficiency assumptions between the Evolving Scenario and Reference Scenario are consequential, in particular, for energy demand. This can be seen in the results for primary energy demand and end-use energy demand.

Primary energy demand is the total amount of energy used in Canada and is calculated in Energy Futures 2020 by adding the energy used to generate electricity to total end-use demand, then subtracting end-use demand for electricity. Figure 1 shows the projection of primary demand by fuel for the Evolving Scenario and the Reference Scenario.

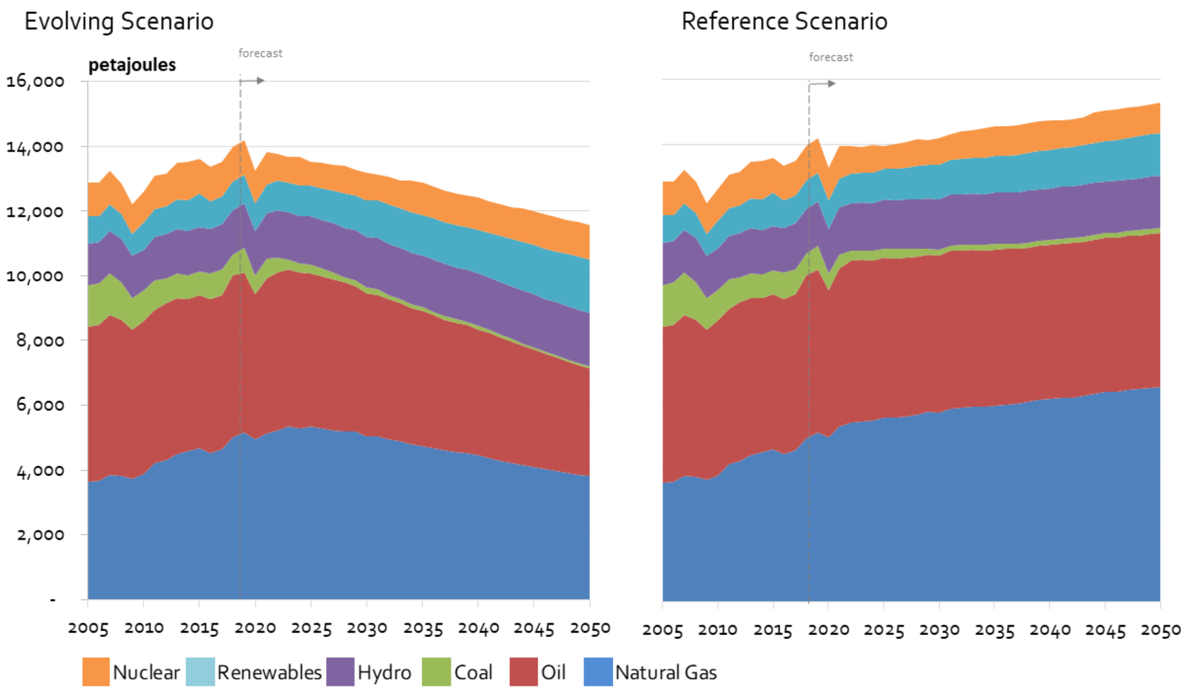


***Figure 1**: Primary energy demand*

In the Evolving Scenario, demand for fossil fuels gradually falls. Coal demand declines considerably due to declining coal-fired power generation. Oil demand falls with improving energy efficiency and electrification of the transportation sector. Driven by increased electrification at the end-use level, overall electricity demand rises steadily. This leads to stable demand for nuclear power and growth in renewable power, as major hydro projects are completed and wind and solar costs continue to fall. Natural gas demand sees significant growth in the near-term, driven by increasing crude oil and natural gas production (both large consumers of natural gas) as well as its increasing role in power generation.

In contrast, the Reference Scenario sees overall demand for fossil fuels gradually increase to 2050. Coal demand declines, but is offset by substantial long term growth in natural gas used for power generation and industry. Oil demand remains relatively stable, driven by steady consumption of transportation fuels. Renewable power generation grows slightly, but less than in the Evolving Scenario.

End-use demand includes electricity, but excludes the fuel used to generate electricity. The results for end-use demand show directly the impact of energy efficiency assumptions. Figure 2 shows total energy use by sector for the Evolving Scenario and the Reference Scenario. In the near-term for both scenarios, energy use follows macroeconomic trends and declines 5.6% in 2020, and then recovers in the next two years. In the long term, however, there is a substantial difference in end-use energy demand between the two scenarios (about 3,600 petajoules by 2050).

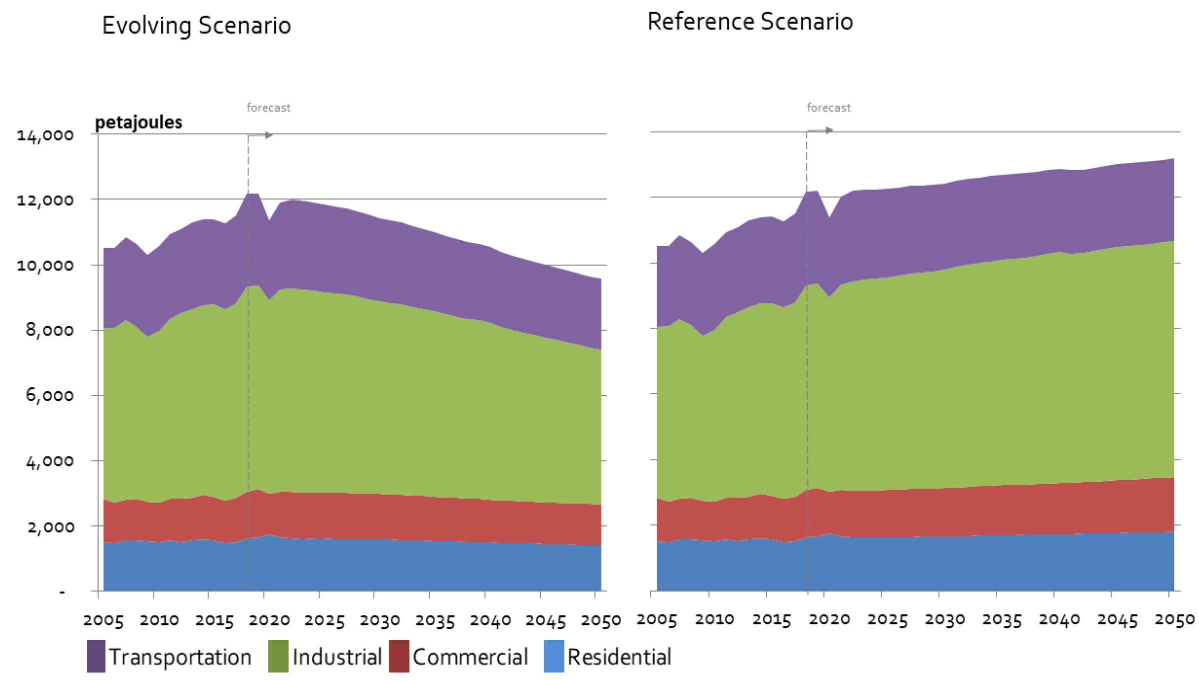


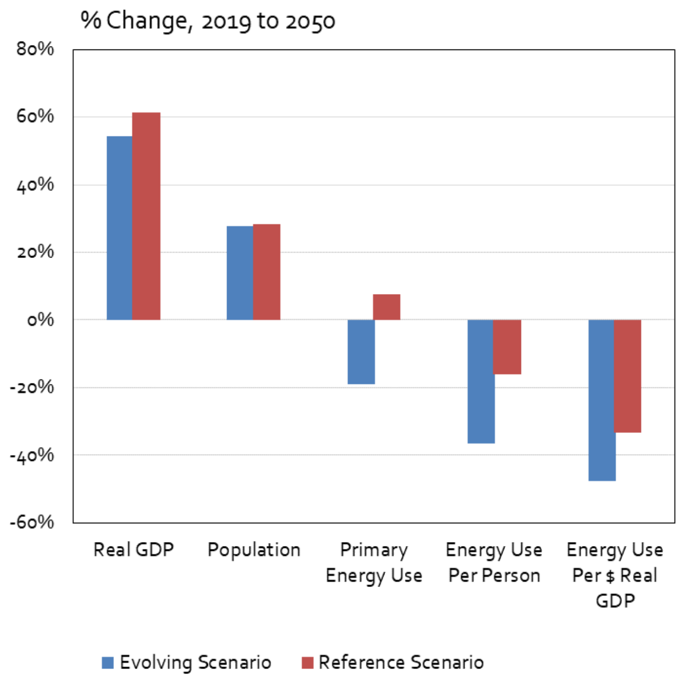
Figure 2*: End-use energy consumption.*

The Evolving Scenario projects Canadian energy use to decline in all sectors from now until 2050. The largest declines are in the industrial (including upstream oil and gas) and transportation sectors. These declines are due to improved energy efficiency, gradual electrification of the transportation sector, and climate policies such as carbon pricing. Economic growth and near-term increases in crude oil and natural gas production provide some upward pressure on energy use. However, economic growth is slower than historical trends, and crude oil and natural gas production eventually decline.

In the Reference Scenario, lack of additional policy action beyond current policies, higher crude oil and natural gas production, less energy efficiency improvements, and less electrification lead to moderate demand growth. These results show the important impacts of policy and energy efficiency.

These impacts are notable when shown in terms of energy intensity (see Figure 3). In the Evolving Scenario, energy use grows much slower than both the economy and Canada's population, resulting in declining energy intensity. From 2019 to 2050, real GDP increases over 60% and population increases over 30% in the Evolving Scenario. Primary energy use declines 18%. These different trends imply that energy use per $ of real GDP declines nearly 50% from 2019 to 2050, while energy use per person declines nearly 37%. In comparison, primary energy use in the Reference Scenario increases over the same time period, while energy use per $ of real GDP and per person decreases much less than in the Evolving Scenario (16% and 33%, respectively

***Figure 3**: Changes in energy intensity.*



Overall, the results of the CER's *Energy Futures 2020* show the important interplay between energy efficiency, energy and climate policies, and energy demand, and the significant impact on Canada's energy future.